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This topic was approved at 6 Oct. S&T Commission mtg

DEPARTMENT OF STATE
DIVISION OF LANGUAGE SERVICES

(TRANSLATION)

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Russian

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STATE COMMITTEE OF
U.S.S.R. COUNCIL OF MINISTERS
FOR SCIENCE AND TECHNOLOGY
11 Gorky Street
Moscow

Electrometallurgy

Dear Mr. Promisel:

I should like to express my satisfaction with the way our scientific and technical cooperation is progressing.

We were pleased to receive in September 1974 a delegation of American metallurgists headed by Prof. R. Vasilevsky. We were able to define jointly a number of questions concerning our cooperation, and we exchanged views on how to step up the implementation of programs in the field of electrometallurgy.

At the present time we have completed preparing the draft program on the topic introduced by you, "Jointing of Materials in a Solid State," which we are sending you for due coordination.

It would be desirable to jointly introduce the above topic at the third session of the Joint Soviet-American Commission on Scientific and Technical Cooperation.

I shall be grateful if you would let me know your views concerning this matter.

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Allow me to wish you, Mr. Promisel, good health and success in our joint work. May I express the certainty that our cooperation will expand successfully as we achieve concrete results.

Respectfully,

[s] S. Antonov
Leader, Soviet part of
Joint Soviet-American Working Group
on Electrometallurgy

# S U B S T A N T I A T I O N

of the draft working program for the topic "Jointing of Materials in a Solid State"

In accordance with the Record of the second session of the Joint Soviet-American Working Group on Electrometallurgy, a draft program for scientific and technical cooperation between the U.S. and the U.S.S.R. on the topic "Jointing of Materials in a Solid State" has been developed. We feel that it would be advisable for both countries to join efforts in solving a number of problems relating to the formation of compound materials by means of solid-state jointing. It is known that the creation of new compound materials with improved physicomechanical and specific physicochemical properties will contribute to further scientific and technical progress in a number of industrial branches.

The problem of forming compound materials with fibrous and laminated reinforcement includes questions concerning the intensification of jointing homogeneous and heterogeneous materials by means of heating and elasto-plastic strain with cyclic and dynamic application of loads under conditions of superplasticity effect, and also by applying superplastic and plastic interfacial layers, etc.; the formation kinetics of physical contact, stable bonds and diffusion effects between the layers of the metallic matrix and metallic and nonmetallic fibers; the mathematical simulation of joint formation processes and calculation of their parameters. In the view of the Soviet side these research subjects must be included in the program of Soviet-American scientific and technical cooperation in this topic.

At the present time considerable progress has been achieved in developing compound materials, specifically in the theory of fiber hardening, the technological processes of jointing materials in a solid phase, the production of reinforcing materials (high-modulus inorganic fibers and ribbons, fabric, whisker crystals, and materials for matrices). The high experimental and methodical standards of these works are also well known.

In view of the above, Soviet-American scientific and technical cooperation in this area appears to be advisable.

The following Soviet organizations will take part in the development of the section indicated in the draft program:

1. A.A. Baykov Institute of Metallurgy of the U.S.S.R. Science Academy
2. Ye.O. Paton Institute of Electric Welding of the Uk.S.S.R. Science Academy
3. Institute of Physics of Metals of the Uk.S.S.R. Science Academy
4. Institute of Problems in the Study of Materials of the Uk.S.S.R. Science Academy

Responsible topic coordinator--Dr. Tech. Sci. V.I. Kashin. The draft program for the topic is attached.

[s] S. Antonov, Dr.Tech.Sci.
Chairman, Soviet part of
Joint Soviet-American Working Group
on Electrometallurgy

LS No. 44520-B

Draft

PROGRAM OF SOVIET-AMERICAN SCIENTIFIC AND TECHNICAL COOPERATION ON THE TOPIC "JOINTING OF MATERIALS IN A SOLID STATE"

| No. | Name of Sections | Subject | Participating organizations | | Completion terms | | Format of completed work | Cooperation forms |
|---|---|---|---|---|---|---|---|---|
| | | | U.S.S.R. | U.S. | Beginning | End | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. | Diffusion jointing of metals. | 1. Investigation of the effect of preliminary mechanical processing of surfaces to determine the kinetics of physical contact formation and of common grains formation during jointing of homogenous metals and alloys. | A.A. Baykov Institute of Metallurgy of the U.S.S.R. Science Academy (Dr. V.I. Kashin, Prof. Dr. M.Kh. Shorshorov), Ye.O. Paton Institute of Electric Welding of the UkS.S.R. Science Academy (Cand.Tech. Sci. Yu.B. Malevsky). | | 1975 | 1976 | Tables, charts, nomograms, reports and papers. | 1. Investigations conducted independently by each side.<br>2. Exchange of testing techniques, materials and samples.<br>3. Joint seminars and meetings to discuss results. |
| | | 2. Investigation and development of methods to intensify the jointing processes of homogeneous and heterogeneous metals. Recommendations for creating new equipment and jointing control methods. | A.A. Baykov Institute of Metallurgy of the U.S.S.R. Science Academy (Dr. V.I. Kashin, Prof. Dr. M.Kh. Shorshorov), Ye.O. Paton Institute of Electric Welding of the Uk.S.S.R. Science Academy (Academician B.Ye. Paton, Prof. Dr. S.M. Gurevich), | | 1975 | 1976 | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| | | | Institute of Physics of Metals of the Uk.S.S.R. Science Academy (Prof. Dr. V.N. Gridnev, Prof. Dr. L.N. Larikov). | | | | | |
| 3. | Investigation of the kinetics of heterodiffusion, the formation of second-phase particles and intermetallic layers and their effect on the strength of joints of heterogeneous metals and alloys. | | Baykov Institute of Metallurgy of the U.S.S.R. Science Academy (Dr. V.I. Kashin, Prof. Dr. M.Kh. Shorshorov, Dr. K.P. Gurov). Ye.O. Paton Institute of Electric Welding of the Uk.S.S.R. Science Academy (Prof. Dr. S.M. Gurevich), Institute of Physics of Metals of the Uk.S.S.R. Science Academy (Prof. Dr. L.N. Larikov). | | | | | |
| 4. | Mathematical simulation and calculation of formation processes of homogeneous joints of metals and alloys, and intermediate phases with interaction of heterogeneous metals. | | Baykov Institute of Metallurgy of the U.S.S.R. Science Academy (Dr. V.I. Kashin, Prof. Dr. M.Kh. Shorshorov, Dr. K.P. Gurov). | | | 1975 | 1977 | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 2. | Jointing of heterogeneous materials in a solid state. | 1.Thermadynamic calculations of conditions under which solid-state joints between heterogeneous materials (metals and ceramics) are formed. | Baykov Institute of Metallurgy of the U.S.S.R. Science Academy (Dr. V.I. Kashin, Prof. Dr. M.Kh. Shorshorov, Dr. V.P. Alekhin). | | 1975 | 1976 | Tables, charts, nomograms, reports and papers. | 1.Investigations conducted independently by each side.<br>2.Exchange of testing techniques, materials and samples.<br>3.Joint seminars and meetings to discuss results. |
| | | 2.Investigation of power and structural characteristics of plastic deformation of surface layers of brittle mono- and polycrystalline materials (ceramics, high-melting metals, etc.) | -"- -"- | | | | | |
| | | 3.Investigation of the kinetics of physical contact formation by the plastic deformation of a softer material (metals or alloys), and of the activation of ceramic surfaces by contact friction. Recommendation for the creation of new equipment and jointing control methods. | -"- -"- | | 1975 | 1976 | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| | | 4. Study of the nature of active centers of chemical interaction of materials, of the formation of intermediate phases and joints and of their effect on the strength of materials. | -"- -"- | | 1975 | 1976 | | |
| | | 5. Mathematical simulation of joint formation processes, and calculation of their parameters. | -"- -"- | | 1975 | 1976 | | |
| 3. | Formation of compound materials by the method of jointing in a solid state. | 1. Investigation and calculation of formation processes of physical contacts, stable bonds and diffusion effects between the layers of the metal matrix and brittle nonmetallic fibers during hot vacuum molding (diffusion jointing). | Baykov Institute of Metallurgy of the U.S.S.R. Science Academy (Dr. V.I. Kashin, Prof. Dr. M.Kh. Shorshorov, Dr. V.I. Antipov).<br><br>Institute of Problems in the Study of Materials of the Uk.S.S.R. Science Academy (Prof. Dr. V.I. Trefilov, Prof. Dr. D.M. Karpinos). | | 1975 | 1976 | Tables, charts, nomograms, reports and papers. | 1. Investigations conducted independently by each side.<br>2. Exchange of testing techniques, materials and samples.<br>3. Joint seminars and meetings to discuss results. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
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| | | 2.Investigation of rolling parameters to obtain stable bonds in multi-layer compound materials, and between matrix layers and metallic and nonmetallic fibers. | Baykov Institute of Metallurgy of the U.S.S.R. Science Academy (Dr. V.I. Kashin, Prof. Dr. M.Kh. Shorshorov) | | 1975 | 1976 | | |
| | | 3.Investigation of residual stresses in compound materials depending on the methods of obtaining them, development of methods to calculate residual stresses and investigation of their effect on the strength of materials. | A.A.Baykov Institute of Metallurgy of the U.S.S.R. Science Academy (Dr. V.I. Kashin, Prof. Dr. M.Kh. Shorshorov, Dr. L.M. Ustinov, Dr. V.V. Belov). | | 1975 | 1977 | | |
| | | 4.Application of acoustical emission to study strain hardening and failure of compound materials. | A.A. Baykov Institute of Metallurgy of the U.S.S.R. Science Academy (Dr. V.I. Kashin, Prof. Dr. M.Kh. Shorshorov, Dr. O.V. Gusev). | | 1975 | 1977 | | |

Chairman, Soviet part of
Joint Soviet-American Working Group
in the Field of Electrometallurgy

[s] Dr. Tech. Sci. S.P. Antonov

Chairman, American part of
Joint Soviet-American Working Group
in the Field of Electrometallurgy

N.E. Promisel